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Miscellaneous Marine and Terrestrial Flatworms from South America

By Libbie H. Hyman[1]

The present article disposes of a small assortment of Turbellaria accumulated over the years that have in common only their origin from South American terrestrial or marine habitats. Most of the specimens were sent for identification by the United States National Museum.

Abbreviations for All Figures

1, Tentacles; 2, nephridial termination; 3, mouth; 4, pharynx; 5, intestine; 6, yolk glands; 7, tentacular glands; 8, penis stylet; 9, common gonopore; 10, testes; 11, adhesive disk; 12, anterior sphincter; 13, ganglion cells (?); 14, gland cells of intestine; 15, posterior sphincter; 16, epidermis; 17, circular muscle layer; 18, longitudinal muscle layer; 19, rhabdites; 20, stalk of adhesive disk; 21, gland cells of adhesive disk; 22, ovary; 23, yolk duct; 24, resorptive vesicle; 25, ootype; 26, seminal receptacle; 27, uterus; 28, sphincter; 29, common antrum; 30, tip of penis stylet; 31, antral glands; 32, seminal vesicle; 33, sperm ducts; 34, prostatic part of penis; 35, glands of ootype; 36, marginal eyes; 37, cerebral eyes; 38, tentacular eyes; 39, uteri with eggs; 40, male gonopore; 41, vaginal cement glands; 42, main penis mass with prostatoids; 43, prostatoids; 44, prostatic vesicle; 45, female gonopore; 46, male antrum; 47, vagina; 48, entrance of oviduct or ovovitelline duct; 49, duct of Lang's vesicle; 50, Lang's vesicle; 51, penis papilla; 52, cerebrofrontal eyes; 53, tentacles; 54, female antrum; 55, ejaculatory duct; 56, common ovovitelline duct; 57, prostatic apparatus (?); 58, pharyngeal cavity; 59, glandular mass.

[1] Research Associate, Department of Fishes and Aquatic Biology, the American Museum of Natural History.

ORDER MACROSTOMIDA
FAMILY MACROSTOMIDAE
Macrostomum tuba (Graff), 1882

Macrostoma tuba Graff, 1882.
Macrostomum tuba gigas Okugawa, 1930.
Macrostomum tubum Hyman, 1936.
Macrostomum bulbostylum Ferguson, 1939.
Macrostomum gigas Hyman, 1943.

A single specimen assigned to this species was collected by Dr. Waldo Schmitt on algae off Cabagua Island, near Venezuela, April 15, 1939. This specimen is about 1 mm. long, hence small for the species, possibly as a consequence of the marine habitat. The specimen was identified by the characteristic stylet, here about 200 micra long, hence comparable in length to that of animals of typical size. The specimen mounted whole has been returned to the United States National Museum.

It is to be hoped that the controversy about this species is now at an end. The trouble was initiated by Kepner and Stiff (1932) who declared that the stylet tip of what they called "the American representative of *Macrostomum tuba*" is peculiar in being reënforced by a heavy ring not found in the European form. Misled by this statement, I interpreted von Graff's original figure of the penis stylet as hollowed at the tip without a thickened wall. I now heartily agree with Luther (1947) and Steinböck (1949) that von Graff's figure is not clear on this point and that I was wrong to redraw this figure with a hollowed stylet tip. Papi (1951) called attention to the article of Weise (1942) who had refound in a warmed pool in the Berlin Botanical Garden specimens quite corresponding to von Graff's original figure, that is, specimens with a short penis stylet and large prostatic vesicle. Weise gave a figure of the stylet tip showing this to have the same thickening as in all other forms of the species. It is therefore evident that Kepner and Stiff were mistaken in regarding this thickening as peculiar to the "American" form (meaning thereby the United States) and that in fact all forms of the species wherever found have this same ring-like thickening of the wall of the penis tip. Weise could not find *M. tuba* anywhere in the Berlin area except in this one botanical pool, and Graff (1882) took the original specimens also in a botanical pool in Munich. It appears to me that the short-styletted form with relatively large prostatic vesicle is limited to Germany, whereas the long-styletted form with smaller prostatic vesicle is widely spread in fresh waters throughout the warm and temperate zones of the world and even occurs, as here reported, in the sea. Both forms have been found flourishing in aquaria. If the long-styletted forms are to be called *M. tuba*

gigas, as apparently Papi (1951) intends, then the short-styletted German forms should be called *M. tuba tuba.* However, I favor designating all forms by the one name *M. tuba* in agreement with Steinböck (1949, 1951) and Ferguson (1954) who now admits that his *M. bulbostylum* is identical with *tuba.* In any case, I withdraw my attempt (1943) to separate *gigas* from *tuba* as a distinct species, although this attempt was not based solely on the character of the penis tip as supposed by Steinböck (1949). There appears to be an array of small differences between the short- and the long-styletted types, but these differences are definitely not of specific rank.

It seems that the word *tuba* is a noun and as the International Rules permit the formation of a scientific name from two nouns in apposition, it was a mistaken attempt on my part, as well as etymologically impossible, to make *tuba* agree in gender with *Macrostomum* by altering it to *tubum.*

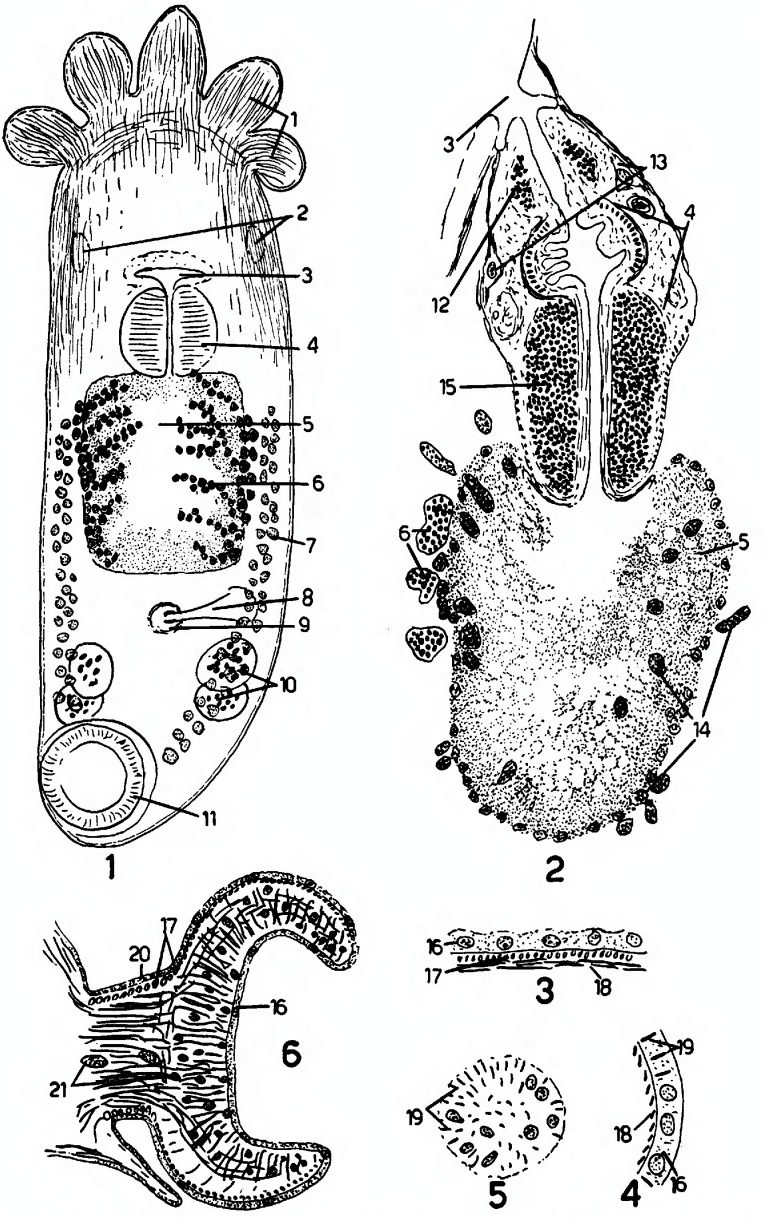
ORDER LECITHOPHORA
SUBORDER TEMNOCEPHALIDA
FAMILY TEMNOCEPHALIDAE
Temnocephala jheringi Haswell, 1893

Figures 1–14

A number of specimens, both juvenile and adult, were sent by the United States National Museum. They were collected on the head and body surfaces and in the mantle cavity of the snail *Asolene platae* (Maton) in the Arroyo Malabrigo, a tributary of the Rio San Javier, 5 kilometers north of Romang, Santa Fé Province, Argentina, no date. The only previously known specimens of this species are the original ones of Haswell's description, taken in the mantle cavity of a snail of the genus *Ampullaria,* in Brazil. This is therefore one of the few species of Temnocephalida that inhabits mollusks.

As the original and only description of this species is somewhat superficial, it devolves upon me to complete the description as well as the material permits. Specimens were sectioned in transverse, longitudinal, and frontal planes and were found in fairly good histological condition. However, without perfect fixation and the use of a variety of differential stains, identification of some of the cell types seen in the sections proved impractical.

Most of the specimens are of more elongated form (fig. 1) than shown by Haswell's figure. The original description gave no dimensions. The maximum length of the specimens is about 1.3 mm., including the tenta-



FIGS. 1–6. *Temnocephala jhringi.* 1. Ventral view. 2. Median sagittal section of digestive tract. 3. Longitudinal section of body wall. 4. Section of tentacular epidermis. 5. Section through tentacle tip, showing rhabdites. 6. Median sagittal section of adhesive disk.

cles, which, however, are contracted to a rounded or oval shape in preserved specimens. In the cleared whole mount (fig. 1) may be seen the digestive tract, the yolk glands spraying over the surface of the intestine, the characteristic funnel-shaped penis stylet, the four testes, a pair on each side near the posterior end, and the terminal adhesive disk, which is pedunculate, as readily seen in a side view (fig. 7). Along each side of the body, from shortly in front of the adhesive disk to nearly the level of the junction of pharynx and intestine is found a longitudinal band of cells (figs. 1, 7), which presumably are the tentacular glands. No effort was made to study the excretory system, of which the termination appears as an oval body on each side in the anterior part of the body (fig. 1). Eyes are wanting.

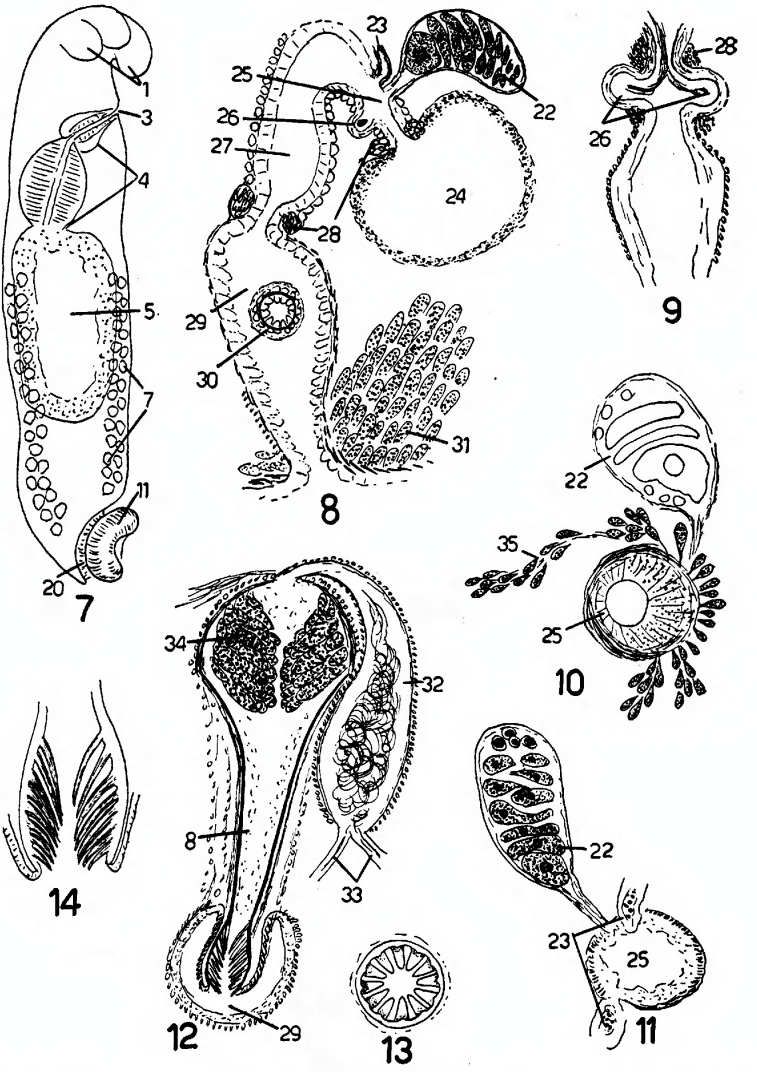
The body is clothed with a cuboidal syncytial epidermis, probably devoid of a cuticle, and bounded by a definite basement membrane from the underlying subepidermal muscle sheath, of outer circular and inner longitudinal fibers (fig. 3). The longitudinal fibers are more strongly developed ventrally than dorsally. They are readily seen in the whole animal extending into the tentacles (fig. 1). The tentacles appear devoid of a subepidermal layer of circular muscles but are well provided with longitudinal fibers that occur not only as a subepidermal layer but also course through the general mesenchyme of the tentacles. The tentacular epidermis differs from that elsewhere on the body in containing rhabdites as short slender rods (fig. 4), most numerous at the tentacular tips (fig. 5). They are said to be formed in the tentacular glands and to reach the tentacles by way of the ducts of these glands.

The caudal adhesive disk, shown in median sagittal section in figure 6, is as usual a highly muscular structure. The body epidermis, practically unaltered, continues over its surface. The subepidermal circular muscle fibers are strongly developed in the stalk of the disk and continue along its sides but appear wanting from the concavity. The interior of the disk is occupied by a strong set of fibers oriented at right angles to the concavity, and these are crossed at right angles by longitudinal fibers descending in the stalk and then bending to follow the curve of the disk. The stalk appears filled with longitudinal fibers, and in some sections these could be seen crossing in the stalk, as also figured in the literature. The disk contains numerous oval bodies filled with eosinophilous granules, and these appear to be sections of the ducts of the gland cells of the disk. The latter, not shown in figure 6, were identified as large gland cells seen in the posterior part of the body at the level of the testes.

The digestive tract, consisting as usual of pharynx and intestine, was well seen in median sagittal sections (fig. 2). The transversely elongated

mouth (fig. 1) leads into a very small pharyngeal cavity into which projects the distal tip of the pharynx. The latter is an elongated body, more complicated than usual in the genus but very similar to the pharynx of *T. semperi* (Merton, 1914). It is bounded from the mesenchyme by a thin membrane, containing proximally circular muscle fibers and distally longitudinal fibers that attach to the angles of the pharyngeal cavity. The most distal part of the pharynx contains a sphincter muscle of circular fibers, the anterior sphincter, surrounded by mesenchyme. This is followed by a region containing a central firm part of cordiform shape surrounded by loose mesenchyme that seems to contain a nerve ring as large cells of ganglionic type may be noticed therein. The cordiform interior of this part of the pharynx is bounded externally by longitudinal muscle fibers followed by circular fibers; the lumen is lined by a sinuous, apparently cuticularized layer of indefinite construction. The last part of the pharynx consists of a large oval mass of circular fibers, forming the so-called posterior sphincter. Actually, however, this would seem to be the effective muscular part of the pharynx. It is lined by the same cuticularized, non-cellular layer as the rest of the pharynx, here rather thickened. The pharynx continues, without the intervention of a definite esophagus, directly into the intestine, which has the usual oblong shape and consists of a granular, highly vacuolated syncytium with basal nuclei. Probably perfect fixation would reveal a cellular construction of the intestinal wall as generally stated for *Temnocephala*. The intestinal epithelium is crossed by the eosinophilous sections of the ducts of the digestive glands, situated around the periphery of the epithelium as described by Merton (1914).

The male reproductive system consists of two pairs of testes, the sperm ducts, and the male copulatory apparatus. A pair of testes in the form of overlapping oval bodies occurs on each side in the posterior part of the animal, shortly in front of the adhesive disk (fig. 1). The common gonopore has a central midventral position, not far behind the posterior end of the intestine (fig. 1). It leads into a considerable common antrum that is continuous to the left with the male copulatory apparatus and to the right with the whole of the female reproductive system except the yolk glands. As the male apparatus lies in the transverse plane (fig. 1) it can be cut parallel to its long axis only in transverse sections. In sections in other planes it is cut crosswise. The two sperm ducts (which could not be traced to the testes) enter the proximal end of the seminal vesicle, an elongated oval body provided with a coat of circular muscle fibers (fig. 12). Contrary to the statement in the original description, this species has a well-developed seminal vesicle. At its distal end the seminal vesicle curves and enters the summit of the penis, an elongated body expanded



FIGS. 7–14. *Temnocephala jhringi.* 7. Side view of juvenile specimen. 8. Median longitudinal section of female tract. 9. Uterus and ootype in frontal section, showing seminal receptacles. 10. Cross section of ootype, showing glands. 11. Cross section of ootype distal to figure 10, showing entrance of yolk ducts. 12. Male copulatory apparatus in transverse section of worm. 13. Cross section of tip of penis stylet. 14. Longitudinal section of tip of penis stylet.

proximally into a prostatic vesicle. The prostatic vesicle has a heavily muscularized wall of circular and longitudinal fibers, and the interior contains a mass of elongated cells encircling a central lumen. These cells are heavily loaded with eosinophilous granules and appear to be themselves the prostatic glands. There was no definite evidence of the presence of external prostatic glands, although cells probably glandular in nature occur in the vicinity of the male apparatus. Distal to the prostatic glands the male apparatus is lined by the funnel-like penis stylet composed of clear, sclerotized material. The penis stylet is covered with a loose sheath of longitudinal and circular fibers. Its tip projects into the common antrum and is armed internally with long, distally pointed spines. A transverse section of the stylet tip is shown in figure 13 and a median longitudinal section in figure 14. From figure 13 it is evident that the spines completely encircle the interior of the stylet tip.

The female apparatus extends dorsally and anteriorly from the right side of the common antrum and hence is cut parallel to its course in median longitudinal sections (fig. 8). A large mass of cement glands filled with eosinophilous granules occurs in front of and around the sides of the distal end of the antrum but not behind it. The common antrum, containing the stylet tip cut transversely, ascends dorsally and is separated by a sphincter muscle from the female tract proper (fig. 8). This sphincter is followed by an elongated section of the female tract that presumably represents the uterus. This narrows and makes a sharp bend forward and downward to become the ootype, a canal that receives a number of structures. There enter it successively a pair of yolk ducts, best seen in cross section (fig. 11), a pair of seminal receptacles, best seen in frontal sections (fig. 9), and the ovary (figs. 8, 11). The last is an oval body attached to the ootype by a short oviduct. It is filled with ovocytes, small at its free end, gradually increasing in size towards the attached end where one very large ovocyte, presumably ready for discharge, is always present. Proximal to the entrance of the oviduct the ootype presents another sphincter muscle and then opens into the proximal chamber of the female apparatus, the resorptive vesicle (vesicula resorbiens), believed to function for the absorption of excess genital products. This has here a hemispherical shape and presses against the posterior wall of the intestine. In some species a passage exists between the resorptive vesicle and the intestine, but no such connection was noticed in the present species. The seminal receptacles (fig. 9) are small hemispherical outpouchings containing sperm, presumably obtained by copulation from another individual. The ootype proximal to the entrance of the yolk ducts receives a number of gland cells (fig. 10) the eosinophilous granules of which dis-

charge into the lining epithelium. The female tract except the resorptive vesicle is invested with a layer of circular muscles that forms sphincters, as already noted, between the antrum and the uterus, between the uterus and the ootype, and at the entrance of the ootype into the resorptive vesicle. The yolk glands are seen in transverse sections through the intestine to surround this organ completely. Study of whole mounts indicates that the yolk follicles spray out over the dorsal and ventral surfaces of the intestine from its sides (fig. 1) where the main ducts are probably located. Each yolk follicle is a more or less rounded body containing a number of darkly staining spherules; a few follicles are represented in figure 2.

A whole mount bearing a number of specimens and two sets of sections have been deposited in the United States National Museum.

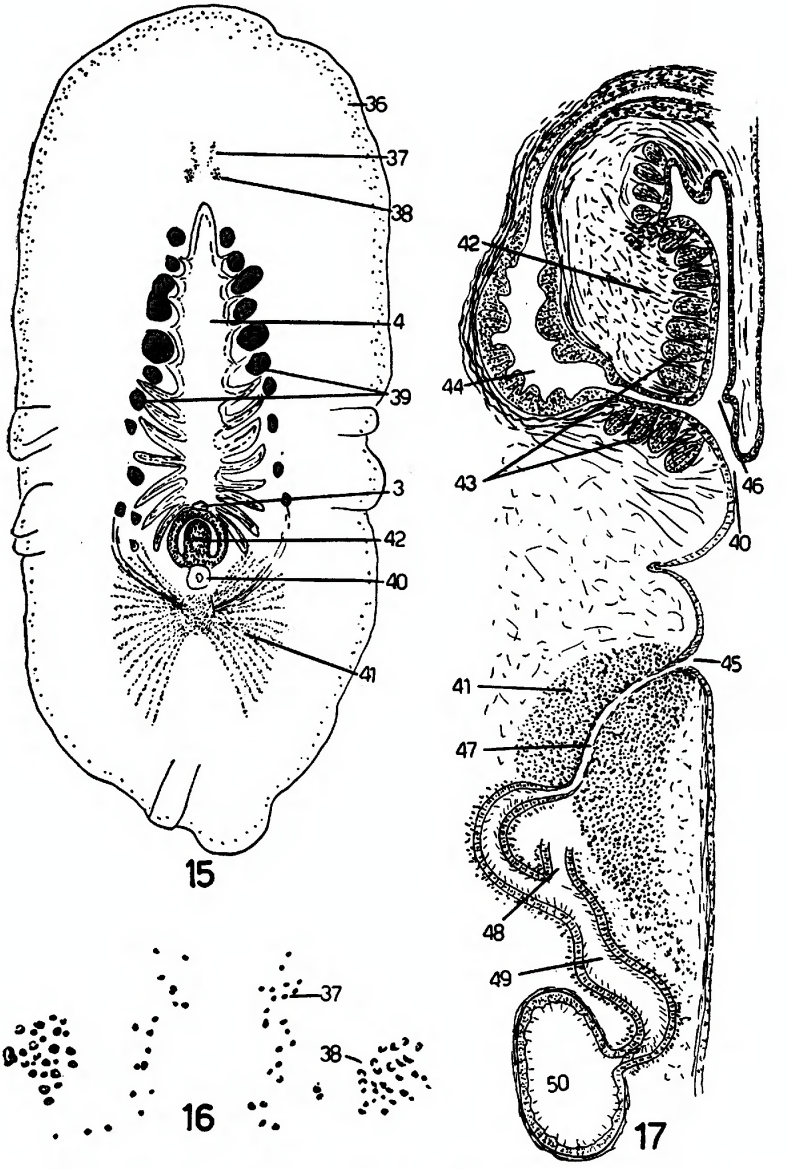
ORDER POLYCLADIDA
SUBORDER ACOTYLEA
SECTION CRASPEDOMMATA
FAMILY DISCOCELIDAE

Adenoplana platae, new species

Figures 15–18

Three specimens that had been collected by the "Albatross" at Station 2765 on January 12, 1888, at 19 meters depth were sent for identification by the United States National Museum. This station is in the vicinity of the mouth of the River Plata off Uruguay, whence the specific name.

The species is of elongated oval shape, anteriorly rounded, posteriorly somewhat narrowed (fig. 15). The largest of the three specimens is 23 mm. long and 10 mm. wide through the anterior half. The color is the usual "museum brown"; in other words, the original color is indeterminable. In the cleared whole worm may be seen the eyes, the pharynx, and the main parts of the reproductive system (fig. 15). Cerebral and tentacular eyes occur in four distinct clusters well separated from the marginal eyes. The tentacular eyes occur as rounded clusters of 20 to 30 eyes, and the cerebral groups form a linear arrangement of 15 to 20 eyes (fig. 16). The margin of all specimens is damaged, so that the arrangement of the marginal eyes is uncertain, but it is conjectured that the marginal eyes encircle the entire margin as represented in figure 15. The elongated pharynx, occupying a central position, is anteriorly poorly lobulated, posteriorly extended into elongated diverticula. The mouth is found at the posterior end of the pharynx (fig. 15), as is typical of the genus, and directly behind the mouth is seen the male apparatus containing numerous



FIGS. 15–17. *Adenoplana platae*. 15. Dorsal view of entire cleared worm. 16. Eye arrangement. 17. Sagittal view of copulatory complex, male part above.

prostatoids; posterior to the male apparatus is found the female canal surrounded by radiating cement glands.

The sexual anatomy, shown in sagittal view in figure 17, is similar to that of other members of the genus. The male antrum, bordered with prostatoids, is nearly filled with a median mass dependent from its dorsal wall and also edged with prostatoids (figs. 17, 18). Only a few of the prostatoids appear in a median sagittal section. The two sperm ducts as they approach the male apparatus develop thickened muscular walls, thus becoming spermiducal bulbs, and take a transverse course, opening separately into the proximal end of the prostatic vesicle (fig. 18). The prostatic vesicle is a curved, fusiform body, forming the dorsal part of the male apparatus and lying above the central mass of the latter. It is lined by a sinuous epithelium, filled with eosinophilous granules, and is coated externally with longitudinal muscle fibers. From it the ejaculatory duct descends at the posterior border of the main central mass and opens into the male antrum that exits to the ventral surface by a posteriorly slanting passage (fig. 17). The structure of the prostatoids, also called by various other names, has been well illustrated by Marcus (1950). These structures seem to be accessory organs of prostatic secretion, but the purpose of such a multiplication of prostatic function in the Discocelidae and a few other polyclad families remains a mystery.

The female pore, well behind the male pore, leads into a narrow, backwardly slanting vagina completely encircled by a heavy mass of cement glands. The inner end of the vagina continues into a broad tube, lined by a definite cuboidal ciliated epithelium. This vaginal tube curves downward, receiving separately the two oviducts, and continues unaltered as a duct that enters the sacciform Lang's vesicle (fig. 17). Lang's vesicle and the female duct to the entrance of the cement glands are well muscularized with a circular coat. Lang's vesicle lacks the anteriorly extending horns present in some other species of the genus.

This is the fourth described species of *Adenoplana*. All four species occur in the West Indian region, using this expression in a broad sense to include the western Atlantic and its adjuncts from the Carolinas to southern Brazil. Two of the species, *A. obovata* (Schmarda), 1859, Jamaica, and *A. evelinae* Marcus, 1950, Brazil, are provided with a small accessory male pore and anteriorly extending horns of Lang's vesicle. Both features are wanting in the present species and in *A. antillarum* Hyman, 1955, taken at St. Thomas, Virgin Islands. The present species differs from *A. antillarum* in eye arrangement and in the form of the female tract which in *A. antillarum* has a wide vagina with lateral pouches that receive the cement glands.

The holotype, consisting of the anterior half as whole mount, and the posterior half as sagittal serial sections (six slides), has been deposited in the United States National Museum.

FAMILY LATOCESTIDAE

Latocestus brasiliensis, new species

Figures 19, 20

This species is represented by three specimens sent by the United States National Museum. They had been collected by Dr. Waldo Schmitt off Sao Francisco, Brazil, October 30, 1925. One specimen is juvenile; the two others are mature.

The worm has the usual slender, elongated shape characteristic of the genus (fig. 19). The largest specimen is 27 mm. long by 6 mm. wide but as it is much ruffled was probably about 40 mm. long in life. The color is indeterminable. There are numerous cerebrofrontal eyes spreading from the brain area to the anterior margin in a fan-like manner, but as the anterior margin is damaged the arrangement shown in figure 19 is slightly conjectural. The marginal eyes completely encircle the margin (fig. 19).

The copulatory apparatus, situated close to the posterior end, is shown in sagittal view in figure 20. It is typical of the genus. The sperm ducts are but slightly developed into spermiducal bulbs as they approach the male apparatus but do have a definite investment of circular muscle fibers. They unite beneath the prostatic vesicle to a common duct, also slightly invested with circular muscle fibers but scarcely forming a definite seminal vesicle. This duct runs posteriorly beneath the prostatic vesicle, slightly diminishing in diameter, and joins the prostatic duct inside the penis papilla. The fairly large prostatic vesicle is an oval body, horizontally oriented, clothed externally with a fairly thick muscle coat of longitudinal fibers; the interior contains elongated fingers of prostatic epithelium. The lumen of the prostatic vesicle curves downward and terminates in the low, broadly conical penis papilla that projects into an antrum of fair size leading to the male gonopore.

The female gonopore lies not far behind the male pore, although distinctly separate from it. It leads into a backwardly slanting female antrum that widens into a vagina lined by scalloped, heavily glandular epithelium, which receives the secretion of the cement glands (not shown). The vagina after slanting forward curves backward, losing its glandular nature, and after receiving from below the common oviduct, continues downward and backward as the duct of Lang's vesicle. The latter is an oval sac of moderate length, about as long as the prostatic vesicle.

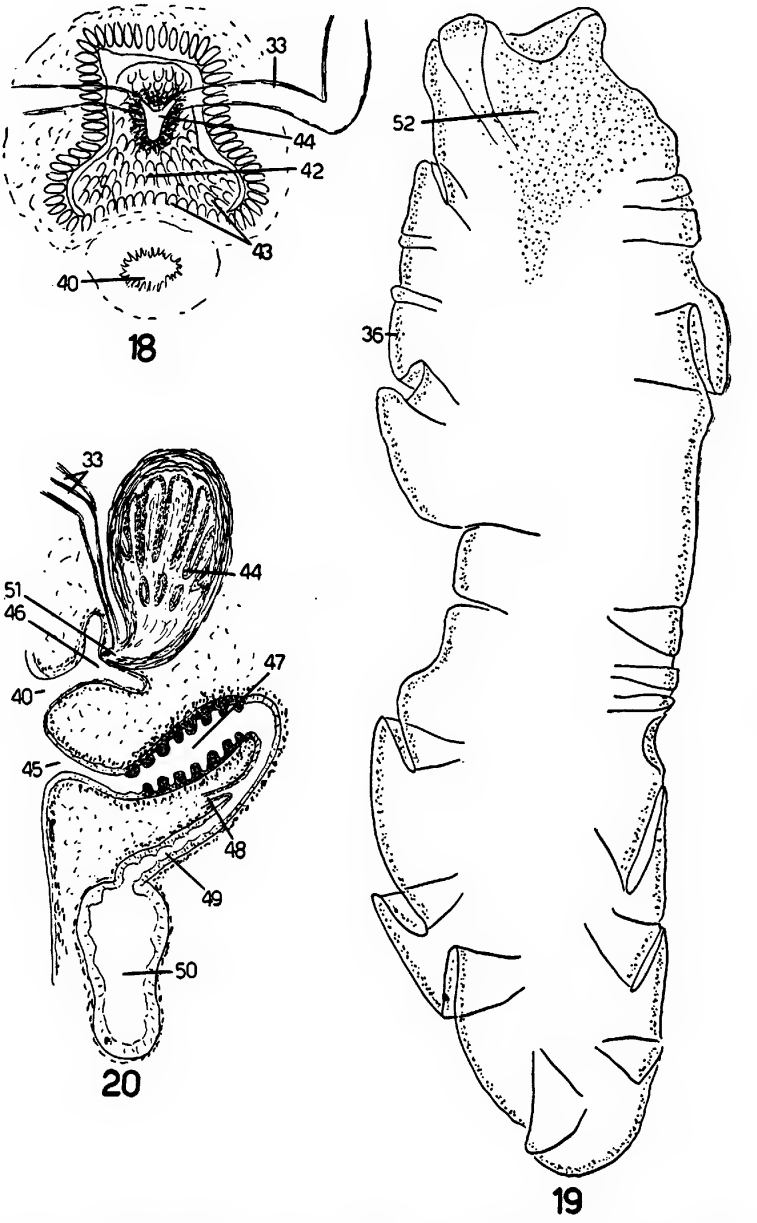


FIG. 18. *Adenoplana platae*, male copulatory apparatus, seen from above in whole mount.

FIGS. 19, 20. *Latocestus brasiliensis*. 19. Dorsal view of entire cleared worm. 20. Sagittal view of copulatory complex, male apparatus above.

I recently (Hyman, 1953) reviewed briefly the genus *Latocestus,* a genus limited to tropical and subtropical waters. The present is the twelfth described species of the genus and the seventh in which the marginal band of eyes completely encircles the margin. *Latocestus brasiliensis* differs from these in the combination of slightly developed spermiducal bulbs, proximity of the gonopores, wide, very glandular vagina, and moderate size of Lang's vesicle. Of the two other species known from the coast of Brazil, *L. atlanticus* Plehn, 1896, has highly developed spermiducal bulbs and a very elongated Lang's vesicle, and *L. ocellatus* Marcus, 1947, possesses a common gonopore. *Latocestus brasiliensis,* in fact, is less similar to previously known Brazilian species than it is to *L. galapagensis* Hyman, 1953. It differs from the latter in the more slender, elongated shape, the more numerous cerebrofrontal eyes, the slightly greater size of Lang's vesicle, and the greater muscularization of the terminal parts of the male ducts.

One whole mount has been deposited in the United States National Museum as holotype, and the set of sections of the copulatory apparatuses (three slides) is also deposited.

FAMILY STYLOCHIDAE

CRASSIPLANA, NEW GENUS

DEFINITION: Stylochidae of oval form and thick opaque consistency; with cerebral eye groups and marginal eyes completely encircling the margin; with a pair of nuchal tentacles containing eyes; male copulatory apparatus with a massive prostatic vesicle; vagina very long, extending anteriorly above the prostatic vesicle and curving ventrally in front of it; without vaginal duct.

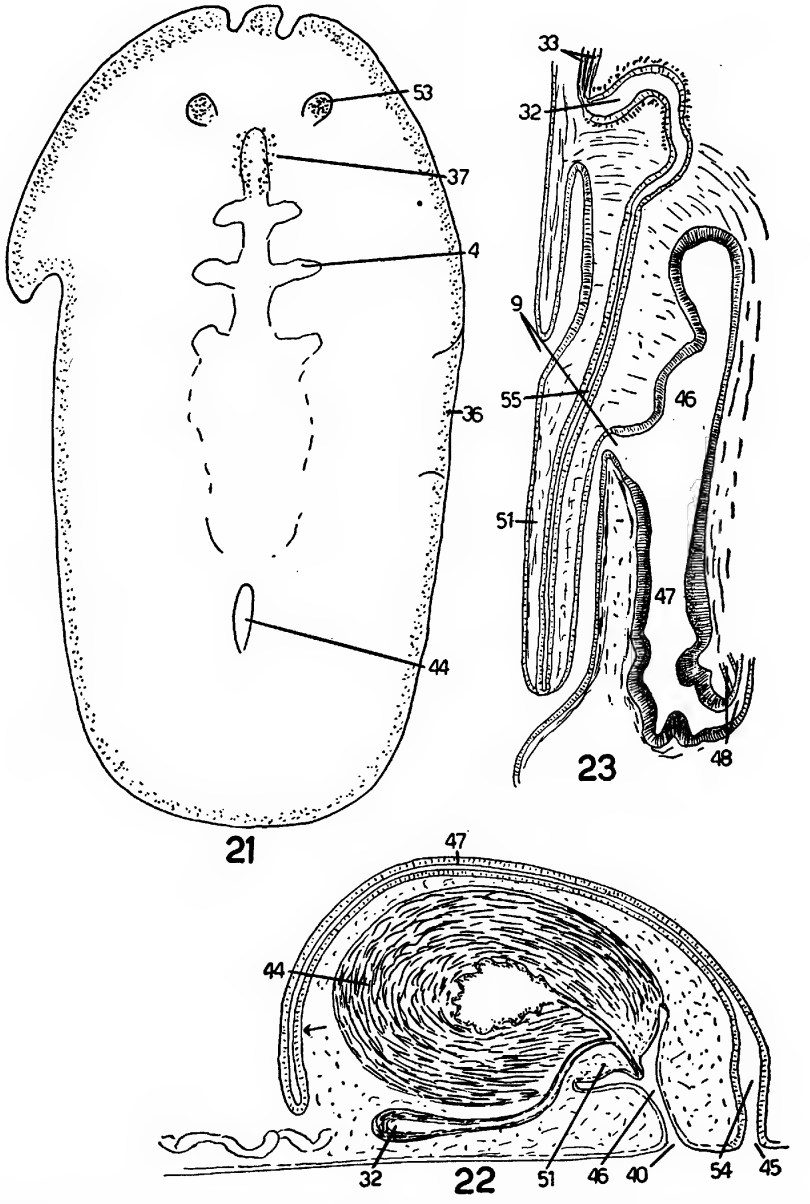
TYPE SPECIES: *Crassiplana albatrossi.*

Crassiplana albatrossi, new species

Figures 21, 22

This species is based on a single specimen collected by the "Albatross" January 12, 1888, at Station 2766, at a depth of about 19 meters. This is the same locality at which *Adenoplana platae* was taken, that is, off the mouth of the River Plata.

The specimen, very dark, thick, and opaque, and somewhat damaged, is of oval form, 14 mm. long by 8 to 10 mm. wide. Because of the very dark color and thick consistency it was difficult to discern any details in the whole cleared specimen. The marginal band of eyes completely encircles the margin (fig. 21). There are present two well-developed tentacles containing a cluster of eyes, and cerebral eyes were also seen although



FIGS. 21, 22. *Crassiplana albatrossi.* 21. Dorsal view of entire specimen; specimen shows damage. 22. Sagittal view of copulatory complex; arrow indicates probable point of entrance of uteri.

FIG. 23. *Geoplana plana*, sagittal view of copulatory complex.

their arrangement could not be determined exactly. Traces of the pharynx were visible, and the massive prostatic vesicle could also be noticed. Such details as were discernible in the whole mount are shown in figure 21.

The rear part was sectioned sagittally and found in very bad condition. The tissues appear fragmented, and the sections would hardly hold together. Nevertheless the copulatory apparatus was present in its entirety, despite many breaks and tears. Unfortunately, also, further damage was done in trying to remove air bubbles from the slides. Hence the sections now do not show so much as when first prepared. Fortunately I had worked out the copulatory apparatus before the final damage was done, so that some details of figure 22 are supplied from memory. Inspection of the copulatory apparatus shows that the worm cannot be fitted into any of the existing genera of the Stylochidae.

The most conspicuous part of the copulatory apparatus is the massive prostatic vesicle with a small lumen and exceptionally thick muscular wall (fig. 22). Below it runs the ejaculatory duct, which proximally enlarges slightly as a seminal vesicle. The sperm ducts could not be traced into the seminal vesicle. The distal part of the ejaculatory duct enters the prostatic vesicle and joins the prostatic duct. The common duct so formed exits through the low, broadly conical penis papilla, housed in the male antrum. The antrum exits by a short tubular passage to the male gonopore. The female pore is situated shortly behind the male pore but is distinct from it. It leads vertically into a female antrum from which the narrowed vagina continues dorsally. The vagina then curves anteriorly and passes above the prostatic vesicle; it then curves ventrally around the anterior end of the prostatic vesicle and terminates at about the level of the seminal vesicle as a slight expansion. The entrance of the oviducts into the vagina could not be found, but the ducts probably enter at the point indicated by an arrow in figure 22, in which case the terminal expansion would represent a small Lang's vesicle. However, this point must be left uncertain.

The holotype, deposited in the United States National Museum, consists of the anterior half as whole mount and the middle of the posterior half as sagittal sections (two slides).

ORDER TRICLADIDA
SUBORDER MARICOLA
FAMILY PROCERODIDAE

Procerodes ohlini (Bergendal), 1899

About 40 specimens of this well-known Magellanic marine triclad were taken by the "Albatross" at Punta Arena in the Strait of Magellan,

January 24, 1888. Sections were prepared and easily identified by means of the accurate study and splendid figures of this species furnished by Böhmig (1906).

Procerodes wandeli Hallez, 1906

A number of specimens of this species were taken at Melchior Harbor, Antarctica, March 10, 1941, by the United States Antarctic Service (collector, J. E. Perkins). Again sections were readily identified by means of the figures furnished by Böhmig (1908).

SUBORDER TERRICOLA
FAMILY GEOPLANIDAE

Geoplana plana Schirch, 1929

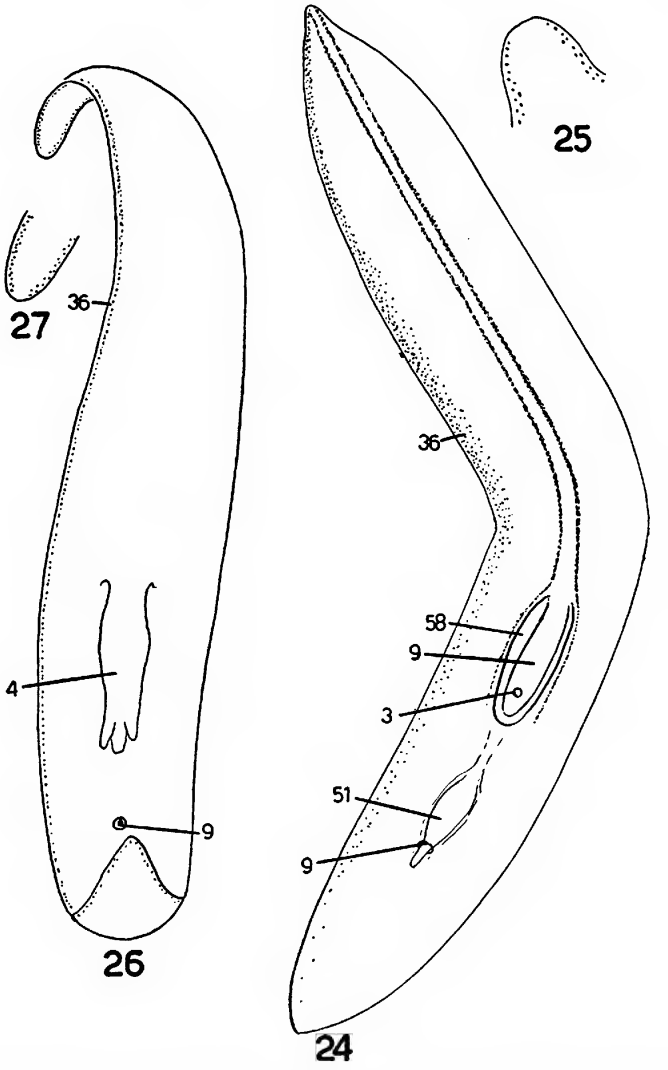
Figures 23–25

A single specimen was sent by the United States National Museum; it had been collected in 1935 by Breno Behr at Sao Bento in the province of Santa Catharina, Brazil.

The worm is very flat and of elongated shape, tapering to each end (fig. 24). It is 60 mm. long by 8 mm. wide but is no doubt somewhat contracted. Schirch (1929) and Riester (1938) give the length in life, extended, as 110 mm. In life the worm is anteriorly more slender than shown in my figure. Both Schirch and Riester present a colored figure and a description of the coloration. The worm is mottled with dark brown on a yellowish brown ground and has a narrow middorsal light streak free from mottling and bordered laterally by dark color. The ventral surface is a plain yellowish gray. My specimen corresponds well enough with this description, and the pale middorsal streak was evident as shown in figure 24, extending from the anterior tip to the posterior end of the pharynx.

Details of figures 24 were added from the cleared specimen. The eye arrangement is not mentioned by my predecessors. As shown in the figure, the entire margin is bordered by a band of eyes, several eyes wide in the middle of the animal, diminishing to the ends. As shown in figure 25, the band of eyes does not cross the anterior tip. The simple tubular pharynx is situated behind the middle of the body with its root 32 mm. from the anterior tip of the worm. The location of the mouth is seen in figure 24. Behind the pharynx the large penis papilla is evident, with its tip protruded through the gonopore, located 44 mm. from the anterior tip of the animal.

The worm is fortunately fully mature sexually, and hence I am able to furnish a description of the copulatory apparatus, now recognized as



FIGS. 24, 25. *Geoplana plana.* 24. As seen from above. 25. Anterior tip, enlarged.

FIGS. 26, 27. *Geoplana bogotensis.* 26. View of entire cleared worm. 27. Anterior tip, enlarged.

indispensable in a taxonomic description of turbellarians. Schirch described only the external features of his material, and Riester's description was based on notes furnished by the collector as the specimen had somehow disappeared. The notes indicate that the Riester specimen was sexually mature. Clearly this is a large species that reaches sexual ma-

turity only at a considerable size. Although the male apparatus is fully developed in my specimen, sperm are not present anywhere.

The region of the copulatory complex was removed and sectioned sagittally; the complex proved in good histological condition. Testes were not present in the sectioned material. The sperm ducts enter separately a small tubular seminal vesicle that takes a sinuous upward course, then curves and narrows to an ejaculatory duct that traverses the center of the very long, cylindroid penis papilla (fig. 23). The latter, considerably muscular, projects from the gonopore for nearly half of its length. From the common antrum the female canal opens widely and extends backward, gradually narrowing and acquiring a thick, glandular epithelium, which is scalloped at the proximal end of the canal. The terminology of the female canal offers some difficulty. By some this canal is termed "antrum," by others "vagina." It appears proper to me to employ the term "female antrum" for whatever part of the canal opening from the common antrum preserves the histological appearance of the latter, that is, is histologically similar to the body wall in the vicinity of the gonopore. Whatever part of the female canal is histologically altered may be considered vagina. On this basis most of the female canal shown in figure 23, having an altered tall glandular epithelium, may be termed "vagina." At its proximal end the vagina curves dorsally as a narrowed passage that receives separately the two ovovitelline ducts coming from the anterior direction. No glands are present attached to the vagina or the terminal parts of the ovovitelline ducts, and hence glandularity would seem to be confined to the epithelial lining of the vagina.

The species appears limited to the province of Santa Catharina, Brazil. As the original description was based wholly on external characters, the identification of the present specimen as *G. plana* must remain somewhat uncertain. However, there is good correspondence as to size, shape, color pattern, and locality.

The specimen minus the copulatory region and the latter as serial sagittal sections (seven slides) have been returned to the United States National Museum.

Geoplana bogotensis Graff, 1899

Figures 26–28

Not *Geoplana bogotensis* Busson, 1903.
Not *Geoplana bogotensis* Fuhrmann, 1912.

A single specimen, collected by the Yale Peruvian Expedition, August 8, 1911, at Tuicochchaca, at an altitude of about 2000 meters, was sent for study by the United States National Museum. The specimen had been

tentatively identified from external characters as *G. bogotensis* by Dr. J. Percy Moore and corresponds so exactly with Graff's description and colored figure that I am constrained to accept the identification, despite the distance of the collection site from the type locality. If the identification is correct, others in the literature since von Graff's description are clearly erroneous.

The worm is 37 mm. long and about 8 mm. wide through the widest part; the gonopore is about 5 mm. behind the mouth (fig. 26). The shape is identical with Graff's figure (1899, pl. 3, figs. 12, 13), rather broad behind the middle, narrowing in a graceful curve to the small anterior end. The pharynx is posteriorly folded (fig. 26) as also noted by Graff. Graff stated that the eyes are arranged in a single row in so far as he was able to follow them. In my cleared specimen the eyes could be seen as a single row along the entire margin (fig. 26), but becoming slightly irregular at the anterior end (fig. 27).

The region of the copulatory complexes was removed and sectioned, and a sagittal view of the apparatuses appears in figure 28. The sperm ducts enter separately the arched, very muscular seminal vesicle that curves ventrally and narrows to an ejaculatory duct. The latter is sinuous at first, then pursues a straight course to the penis, where it terminates on a conical eminence projecting into the lumen of the penis papilla. The latter is short and broad, with a truncate free end; its lumen is asymmetrically placed nearer the ventral side of the papilla. The common gonopore leads into a small common antrum from which the wide female antrum extends posteriorly. From it the vagina begins as a narrow tube that expands posteriorly into a thick oval structure, lined by a tall glandular epithelium and coated with heavy muscle layers, of inner circular and outer longitudinal fibers. At its proximal end the vagina receives the common ovovitelline duct that curves forward, paralleling the vagina, and has a slight expansion where it receives the two ovovitelline ducts. The common ovovitelline duct is accompanied by eosinophilous cement glands. Altogether the whole copulatory apparatus presents a rather complicated appearance.

In 1903 Busson described under the names *G. bogotensis* and *G. bogotensis bürgeri* specimens from the Bogota region that he ascribed to Graff's species. Fortunately he gave a figure of the copulatory apparatus, seen to be quite different from that of the present specimen. Fuhrmann (1912) refound in Colombia specimens clearly identical with Busson's worms and also identified them as *G. bogotensis* Graff. He declared the variety *bürgeri* to be without validity, merely an insignificant variant. It appears to me that the specimens of Busson and Fuhrmann are not *G.*

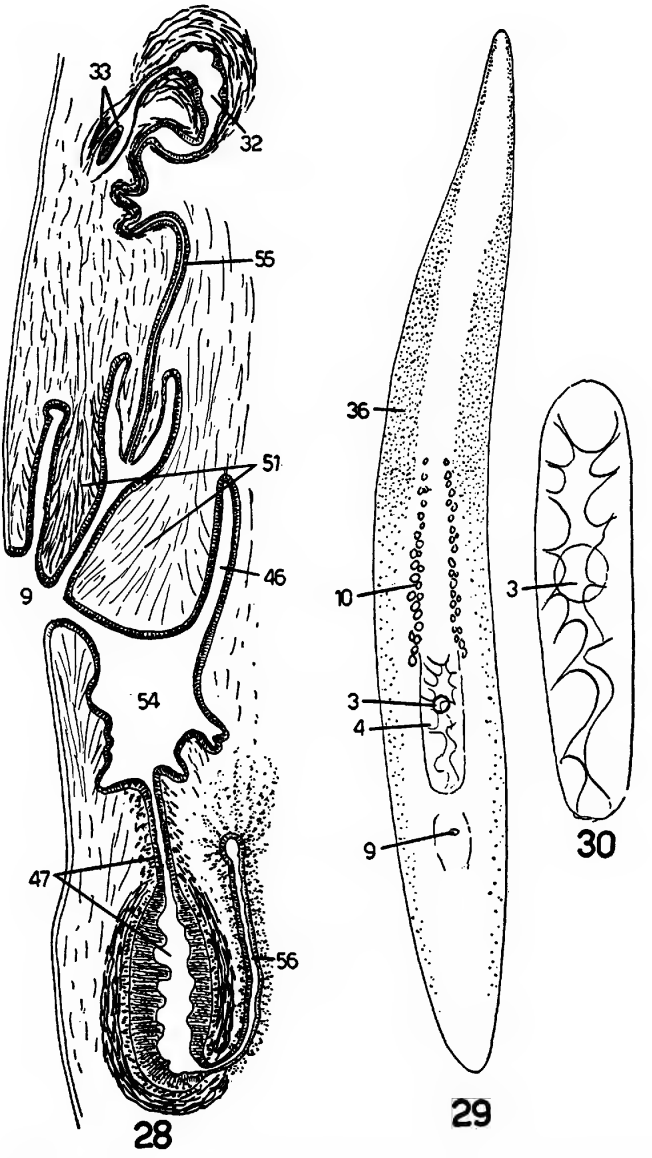


FIG. 28. *Geoplana bogotensis*, sagittal view of copulatory complex, male apparatus above.

FIGS. 29, 30. *Geoplana contamanensis*. 29. View of entire cleared specimen. 30. Pharynx, enlarged.

bogotensis. For one thing they are much larger, reaching a length of 60 to 70 mm. and attaining full sexual maturity only at a length greater than 45 mm. The surmise of Fuhrmann that Graff's specimen was juvenile is inadmissible as Graff depicts a conspicuous gonopore. As another point, Fuhrmann's description of the eye arrangement of his worms differs altogether from Graff's statement. According to Fuhrmann the band of eyes rapidly increases in width and at a distance of only 13 mm. from the anterior end is already about seven eyes deep. Posterior to the pharynx only isolated and widely separated eyes occur. It is probable that the true *G. bogotensis* has but a single row of eyes along the entire margin. I am of the opinion that my specimen corresponds better with the original description and that the specimens of Busson and Fuhrmann are a different species, to which the name *G. bürgeri* is applicable in accordance with nomenclatorial rules.

Riester (1938) declared *G. bogotensis* to be a synonym of *G. ferussaci* Graff, 1899. This decision was based on comparison of specimens ascribed to *ferussaci* with a specimen found in the Hamburg Museum labeled *G. bogotensis*. But the latter is clearly misidentified and actually is a specimen of *ferussaci*. The eye arrangement of *G. ferussaci* depicted by Riester disagrees altogether with Graff's statement for *bogotensis*, and the copulatory apparatus of *ferussaci* as figured by Riester differs from that of the present specimen, also from Busson's figure. It is further improbable that a species from the high Andes would also occur in the coastal area of Brazil. *Geoplana bogotensis* would seem to be an alpine species, found in the Andes at altitudes from 2000 to 3600 meters.

The specimen minus the copulatory region and the latter as sagittal serial sections (seven slides) have been returned to the United States National Museum.

Geoplana contamanensis, new species

Figures 29–31

A single specimen was taken by an American Museum expedition at Contamana on the Ucayali River in northeastern Peru, at an altitude of about 300 meters, in March, 1927.

This is a large species, 72 mm. long and 8 mm. wide across the widest part. The form is that usual in the genus *Geoplana*, broad and flat in the pharyngeal region, tapering posteriorly to a blunt end, and anteriorly more gradually to the narrow head (fig. 29). The root of the pharynx is located about 40 mm. from the anterior end, the mouth at 45 mm. from the anterior end, and the gonopore about 12 mm. behind the mouth. The pharynx, much folded (fig. 30), was readily seen in the cleared specimen.

The eye arrangement is shown in figure 29. The band of eyes is single on the anterior end, not encircling the tip, and rapidly increases in width to a level about two-fifths of the body length. The band is here many eyes deep and reaches to the middorsal area. Posterior to this level the number of eyes and width of the band decrease rapidly, and behind the genital region the margin bears only a few, irregularly arranged eyes, which do not seem to reach the posterior end. The color appeared to be a uniform dark brown above, possibly with a few darker markings, lighter brown below.

The region of the copulatory complex was removed and sectioned sagittally. The sections revealed the apparatus as very long and complicated (fig. 31). The sperm ducts enter separately what appears to be a prostatic apparatus, not, to my knowledge, previously described for any other species of *Geoplana*. This apparatus consists of an oval, nonmuscular projection into a cavity lined by a heavily eosinophilous epithelium underlain by a mass of eosinophilous glands. The eosinophilous secretion filled the cavity but has not been represented in figure 31. The sperm ducts could not be traced through the central projection and, as the material is in good histological condition, must be supposed to have not yet completed themselves. It seems necessary to assume that they eventually open on the free end of the projection. The latter is clothed with a tall ciliated epithelium. From the cavity of the prostatic apparatus a rather wide ejaculatory duct, lined by a glandular epithelium staining blue with haematoxylin, proceeds posteriorly to open through the penis. The latter is a lobulate organ with some small lobes around the entrance of the ejaculatory duct and one large dorsal lobe filling much of the male antrum. The penis lobes are clothed with a tall epithelium of eosinophilous nature; the epithelial cells themselves are filled with eosinophilous granules.

As the female canal is lined throughout with a glandular epithelium it may be regarded as a vagina. It begins widely from the male antrum, then narrows somewhat, then has a proximal widened region where the glandular epithelium is thrown into folds. This proximal part receives from above the common ovovitelline duct accompanied by numerous eosinophilous cement glands. The glandular lining of the vagina is of a different nature, taking the haematoxylin stain. Thus the lining of the prostatic cavity, the epithelium of the penis lobes, and the ovovitelline duct are eosinophilous, whereas the ejaculatory duct and the lining epithelium of the vagina stain blue with haematoxylin.

This species differs from other *Geoplana* species in the presence of a prostatic apparatus.

The specimen constitutes the holotype deposited in the American Museum of Natural History; it is mounted whole except for the copulatory region, sectioned sagittally (eight slides).

Geoplana ucayalensis, new species

Figures 32–35

A single specimen was taken on the same occasion and in the same site as the preceding species.

This is a very large worm, measuring about 90 mm. in length and 9 mm. in width at the widest part. The body is broad and flat, with sides about parallel for much of the body length, then tapering to the body ends (fig. 32). As usual in *Geoplana,* the tapering is more pronounced anteriorly than posteriorly, and hence the head end is somewhat abruptly narrowed to a slender shape.

The color pattern is distinctive and appears well retained in the preserved specimen (fig. 32). On a medium brown ground, which darkens laterally, are found two very broad dark brown stripes that begin on the head region and extend for about one-fourth of the body length. They are continued to the posterior end by spots of the same color irregularly arranged but confined to the same area as the stripes, thus leaving the middorsal region free of spots.

The eye arrangement is shown in figure 34. The eyes begin as a single row encircling the tip of the head (fig. 33). The row rapidly increases in width, occupying the width of the dark stripes. Although these stripes appear to the naked eye uniformly colored, they in fact contain numerous lighter dots, and each such dot harbors an eye. This condition in which each eye is surrounded by a light halo is quite common in the genus *Geoplana.* After the dark stripes have broken up into spots, the eyes appear limited to these spots where they also occupy light dots in the spots. Towards the posterior end of the animal, where the spots are reduced in size, each such small spot contains one eye.

The mouth is found at a distance of about 50 mm. from the anterior tip. The much folded pharynx (fig. 35) projects from the mouth opening.

Despite its large size, the worm is not sexually mature. The most careful scrutiny of the cleared worm failed to reveal any gonopore, although some traces of the copulatory apparatus seemed to be present. It seemed best under these circumstances to leave the worm whole as a holotype. It is deposited in the American Museum of Natural History.

Distinction from the numerous other species of the genus *Geoplana* rests on color pattern and eye arrangement.

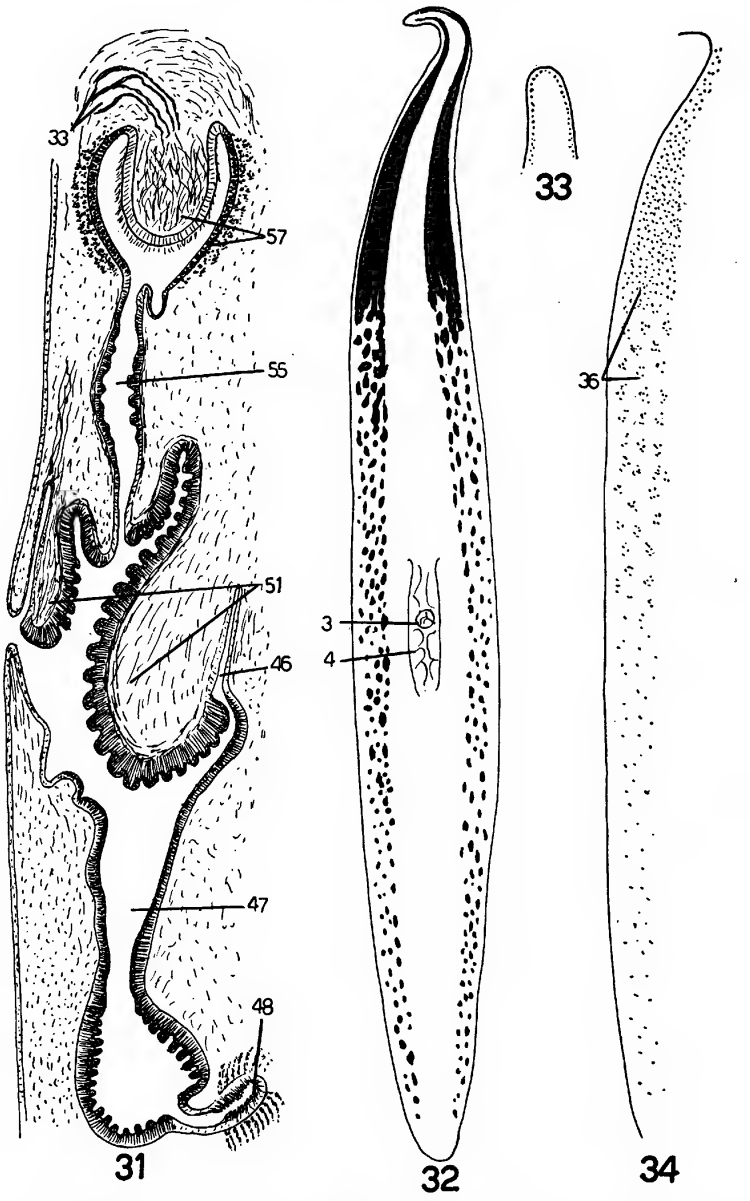


FIG. 31. *Geoplana contamanensis*, sagittal view of copulatory complex, male apparatus above.

FIGS. 32–34. *Geoplana ucayalensis*. 32. Dorsal view of cleared specimen. 33. Anterior tip, enlarged. 34. One side, showing eye arrangement.

Geoplana unicolor, new species

Figures 36, 37

This species is represented by one worm, taken by the Yale Peruvian Expedition at Lucma, Peru, at an altitude of 2100 meters, August 7, 1911. It had been tentatively identified by Dr. J. P. Moore as *Geoplana rufiventris,* but this identification is clearly erroneous, as *rufiventris* is a very large species and further, so far as known, is limited to the central eastern coast of South America.

The worm is small, 25 mm. long, but somewhat broad (4 mm. at the widest part) with the usual narrow head (fig. 36). The mouth is located 14 mm., and the gonopore 17 mm., from the anterior tip. The color is uniform dark brown above, pale below with wide dark brown margins. Because of the dark color, the eye arrangement could not be definitely ascertained. A few eyes in a single row were seen on the sides of the head, and this row definitely does not cross the anterior tip. The pharynx appears of simple, cylindrical contour.

Despite its small size the cleared worm was seen to be in full sexual maturity and the sperm ducts and large penis papilla were discernible behind the pharynx. This region was therefore removed and sectioned sagittally, and a sagittal view of the copulatory apparatus appears in figure 37. No testes were present in the region sectioned. The two sperm ducts, containing sperm, enter the proximal end of the crescentic, muscularized seminal vesicle. At its distal end the seminal vesicle narrows to a long ejaculatory duct that traverses the middle of the elongated, cylindrical penis papilla. The sinuosity of the distal end of the penis papilla is probably an accidental result of contraction on fixation. The distal half of the penis papilla is clothed with a heightened glandular epithelium of eosinophilous nature. The epithelium lining the tubular exit of the antrum to the gonopore is notably thickened. From the common antrum, the female antrum opens widely in the posterior direction and soon passes into the broad vagina lined by a glandular epithelium thrown into regular circular folds. At its proximal end the vagina then narrows and, curving ventrally, receives separately the two ovovitelline ducts, which are liberally supplied with cement glands.

This species is distinguished by its small size, uniform coloration extending to the ventral side as broad lateral bands, and details of the copulatory apparatus.

The specimen constitutes the holotype with anterior part mounted whole, posterior part as sagittal sections (five slides), deposited in the United States National Museum.

Geoplana diminutiva, new species

Figures 38–40

The single specimen was collected at the River Charape, Peru, September 17 (no year), by C. H. T. Townsend for the United States National Museum.

This is a very small member of the genus, only 15 mm. long. To the naked eye it appeared uniformly black above and pale gray below, but when cleared a pattern became evident as in figure 38. On a dark brown ground there were present two broad black lateral stripes and a very narrow middorsal stripe. The outer lateral stripe continues around the head just to the inner side of the row of eyes (fig. 39). The inner lateral stripe ceases as a thin line on the head region. Posteriorly the two stripes appeared fused for part of their course but were seen to separate again in the tail end. The narrow median stripe seemed incomplete. Because this worm was rolled up into a coil and could not be satisfactorily straightened, the pattern was not well made out. On account of the black background the eyes could not be followed and were detectable only on the head where they encircle the tip (fig. 39).

The mouth is located about 10 mm. from the anterior tip. The pharynx (fig. 40) is of a short, bell shape, greatly folded, but probably much contracted, as a long length of empty pharyngeal cavity appears behind it in the sections. The main mass of the copulatory apparatus appeared in the cleared whole animal about 2 mm. posterior to the mouth.

No gonopore could be found in the cleared whole animal, and hence it was surmised that the specimen was not fully mature. However, as parts of the copulatory apparatus could be discerned, the sexual region was removed and sectioned sagittally. It was found in fact not fully developed, but the main structures are present and are depicted in figure 40. There is no gonopore, but the tubular channel leading from the antrum is present. Anteriorly this connects to the male antrum of elongated oval form and lined by a thickened glandular epithelium. At the proximal end of the male antrum some folds represent a penial structure. From this the ejaculatory duct can be followed to a spherical seminal vesicle with a muscular wall. At its distal end the male antrum is continuous with a short funnel-like female antrum that narrows at its proximal end to receive the ovovitelline ducts, although these are not developed as yet.

The color pattern, small size, and details of the copulatory apparatus serve to distinguish this species. The specimen, in part as a whole mount, and in part as sections (three slides), has been deposited as holotype in the United States National Museum.

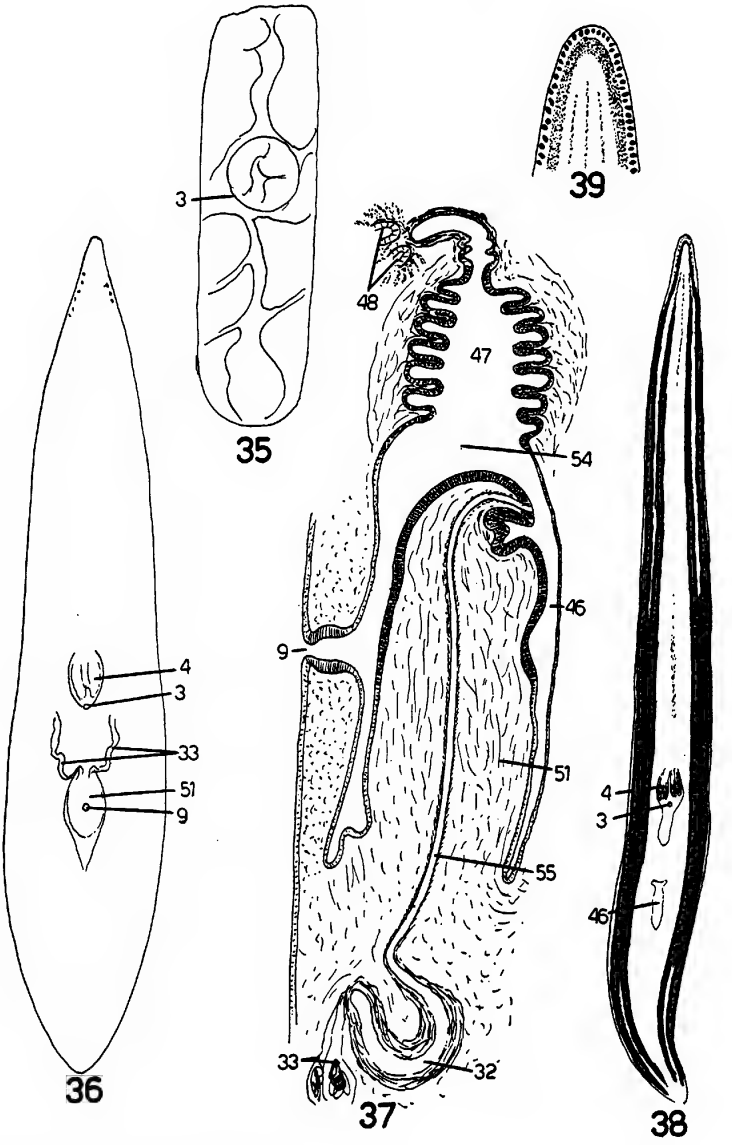


FIG. 35. *Geoplana ucayalensis*, pharynx.

FIGS. 36, 37. *Geoplana unicolor*. 36. Dorsal view of cleared specimen. 37. Sagittal view of copulatory complex, female apparatus above.

FIGS. 38, 39. *Geoplana diminutiva*. 38 Dorsal view of cleared worm. 39. Anterior tip, enlarged.

Until recently scarcely any land planarians were known from Peru, but in 1951 Eveline Marcus described 14 new species of *Geoplana* from Peru, and the present article adds four more new species of *Geoplana* from that country. I am not able to identify any of my forms with Marcus' species and hence must regard them as undescribed. Very likely Peru has a rich geoplanid fauna on which only a slight inroad has been made to the present time.

FAMILY RHYNCHODEMIDAE
SUBFAMILY RHYNCHODEMINAE
Rhynchodemus angustus (Hyman), 1941

Figure 41

Desmorhynchus angustus HYMAN, 1941.

A lot of four specimens was sent by the United States National Museum. They had been collected at Cerro Punto, Province of Chiriqui, Panama, at about 2000 meters elevation, by Eric Graeta, in November, 1949.

The specimens vary in length from 30 to 40 mm. As noted in the original description, specimens 30 mm. or less in length are juvenile, without reproductive system. Gonopores were evident on the present specimens that had reached a length of 35 to 40 mm. In such specimens the gonopore occurs 9 to 13 mm. behind the mouth. The copulatory region was sectioned of two specimens but was found fully mature only in the larger of the two. In this one, unfortunately, the vagina is almost completely filled with a parasitic protozoan, apparently a gregarine. Figure 41 therefore combines the male apparatus of the larger specimen with the vagina of the smaller one.

The copulatory apparatus is depicted in sagittal view in figure 41. The sperm ducts enter separately the proximal end of a sinuous expanded tube that presumably represents the seminal vesicle. Its epithelium is in fact provided with a musculature of considerable width, but it differs from the usual seminal vesicle in being surrounded by a dense glandular area. This consists of some eosinophilous glands dorsal and ventral to the main expansion of the tube, but the greater part of the glandular mass stains blue with haematoxylin, and from this main mass similarly staining glands extend in strands for some distance anterior to the seminal vesicle. The latter seems therefore to combine the functions of seminal and prostatic vesicle.

Distally the seminal vesicle widens and enters the anterior end of the long male antrum. This is not set off definitely from the surrounding mesenchyme. As typical of the genus *Rhynchodemus,* the male antrum

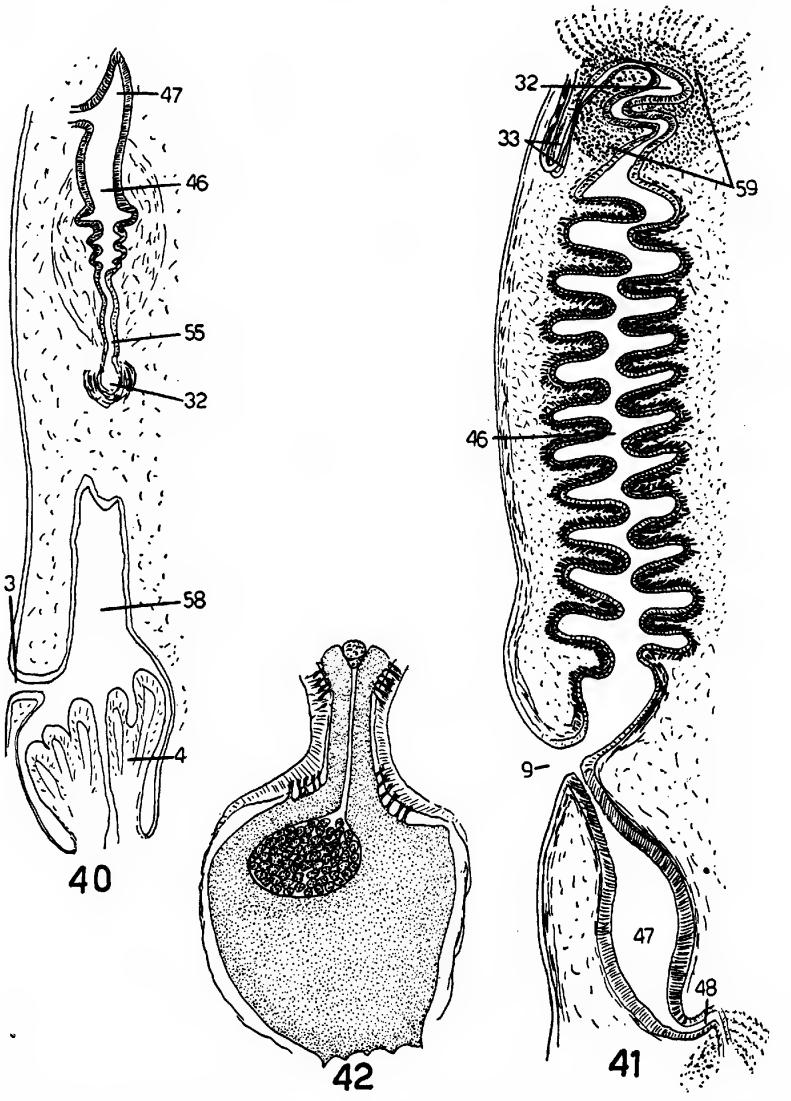


FIG. 40. *Geoplana diminutiva*, sagittal view of copulatory complex, female apparatus above.

FIG. 41. *Rhynchodemus angustus*, sagittal view of copulatory complex, male apparatus above.

FIG. 42. Gregarine parasite in vagina of *Rhynchodemus angustus*.

lacks a penis papilla. Its interior is thrown into numerous tall folds that actually probably are circular ridges of the wall. These ridges are clothed with a cuboidal eosinophilous epithelium, and this is underlain by a heavy musculature of inner fibers that parallel the contours of the ridges followed by circular fibers. The circular fibers are especially strong and are very evident wherever the section passes through the surface of the ridges. At its distal end the male antrum narrows to a small common antrum opening below by the common gonopore and leading posteriorly by a narrowed passage into the slightly expanded vagina lined by a columnar epithelium and rather lacking in muscular investment. The vagina narrows proximally and, making a slight upward bend, receives the ovovitelline ducts accompanied by strands of cement glands.

I am pleased to be able to complete the description of the species by an exposition of the copulatory apparatus, distinguished by the glandularity of the seminal vesicle and the greatly folded wall of the male antrum. A similar glandularity of the seminal vesicle was described by Eveline Marcus (1953) for *Rhynchodemus graetzi,* also from Panama. *Rhynchodemus graetzi* differs from *angustus* in the slight folds of the male antrum and the presence of an antral muscle definitely wanting in *R. angustus.*

Parasite of *Rhynchodemus angustus*

Figure 42

As indicated above, there was found in the larger specimen of *R. angustus* that was sectioned a protozoan parasite almost completely filling the cavity of the vagina. This parasite appears to be a gregarine. The body has the shape of a Florentine flask. Its expanded part occupies the lumen of the vagina and has destroyed the epithelium of the lateral vaginal walls. The neck of the parasite occupies the narrowed proximal end of the vagina, and here the columnar vaginal epithelium has been retained. This epithelium is permeated with root-like extensions from the parasite. A remarkable feature of this parasite is that its neck is hollow, containing a tubular cavity that leads into an oval cavity in the body of the parasite; the latter cavity appears filled with the yolk cells of the host. In fact it would seem that the gregarine feeds by ingesting the yolk cells of the flatworm as they pass from the ovovitelline ducts into the vagina. Other cases of ingestion of formed food by gregarines are quoted by Grassé (1953, p. 612). The posterior end of the parasite also has some root-like extensions into the surviving epithelium. I was not able to find any nucleus, and the cytoplasm appeared without structure, taking heavily a uniform eosinophilous stain. It would seem that the presence of the parasite would effectively block sexual reproduction of the host worm.

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